



ASSESSING THE IMPACT OF BIODIVERSITY LOSS ON HUMAN HEALTH AND LIVING STANDARDS

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ABSTRACT

The environmental impacts of human industrialization and expansion have long been a source of debate. Of these, biodiversity loss is one whose effects on humans are difficult to quantify. In this paper, we attempt to outline the damaging effects a loss of biodiversity has on human health and wellbeing by evaluating increased rates of disease, crop failures, and infrastructure damage caused by disruptions in a healthy ecosystem. We further this discussion by providing the implications of biodiversity loss in developing nations with little to no defense against the damage caused. Despite being overshadowed by climate change - the overarching environmental crisis Earth is facing - we further discuss how controlling biodiversity loss can be key in combatting our warming climate as well, and thereby promoting human health and wellbeing indirectly as well.

KEYWORDS: Biodiversity loss, climate change, pollution, ecosystem, food security.

INTRODUCTION

Homo Sapiens are a species that has incredible adaptive power, a skill that has enabled them to spread across continents and touch every corner of the world in a relatively tiny span of geologic time. However, as humanity has indulged in a race to gather natural resources and capital, we have developed a slew of unintended consequences, some of which are already proving to be detrimental to the health and wellbeing of our environment—and by extension, humanity itself. One such consequence of the so-called Anthropocene (literally translated to age of humans) is a massive decline in biodiversity. As humans have diminished and fragmented natural habitats, disrupted ecosystems, caused widespread pollution, and damaged the food chain balance, the biological diversity of species worldwide has experienced stark decline. The effects of this phenomenon have been long debated, begging the question: what are the implications on human health and wellbeing caused by the loss of biodiversity? Although this issue is given little attention in the face of other environmental disasters caused by humans, it is clear that human health and living standards are at high risk due to increased rate of disease and diminished ecosystem services stemming from biodiversity loss.

Background & History

Biodiversity loss can be defined as a “decline in the number, genetic variability, variety of species, and the biological communities in a given area” (Rafferty, 2022). The loss of biodiversity in our current geologic era has far exceeded the natural rate of extinction. The root cause of this is the swift rate of human expansion. Researchers have identified five crucial drivers in loss of biodiversity on a worldwide scale: habitat loss and degradation, overexploitation of resources, invasive species, pollution, and climate change. However, ecologists emphasize and reiterate that habitat loss has been the primary contributor to the crisis as a whole: almost half of the world's habitable land (some 51 million square km) has been converted to agriculture, and this demolition of natural grassland, forest, and wetland habitat has caused an average 60% percent decline in the number of vertebrates worldwide since 1970 (Rafferty, 2022).

Nevertheless, it is a combination of this massive decline in habitat with other factors contributing to biodiversity loss that has put Earth's biosphere into a state of crisis. Researchers at the Stockholm Resilience Center place the current extinction rate at more than 100 extinctions per million species per year, and rising (Rockström, 2017). That compares with a natural “background” extinction rate of around 0.3 species a year. With these statistics, it is evident that humanity's influence on the natural world has far exceeded the natural planetary boundaries.

Study Motivator

Loss of biodiversity has led to diminishing human health and wellbeing worldwide, especially in developing countries with lower resistance to the risks posed by biodiversity loss. The risks are not evident over a short time period, yet the impacts of biodiversity loss on ecosystems and the services they provide humans have been seen and will only continue to grow. Ecosystem services are defined as “outputs, conditions, or processes of natural systems that directly or indirectly benefit humans or enhance social welfare” (Rafferty, 2022). These include robust crop yield due to a healthy population of pollinators, attenuation of flooding in residential areas by riparian buffers, the regulation of threatening pathogens by decomposers and scavengers, and the prevention of soil erosion by forests. As a loss of biodiversity continues to threaten already-fragile ecosystems damaged by human exploitation, the risks it poses are in need of being addressed. This study uses a fair, comparative analysis between both primary documents of

data collected from UN bodies and nonprofit organizations such as the WWF as well as research conducted in various areas of study. By applying this research to a comprehensive topic, we find the various perspectives on the issue to be illuminating.

Literature Review

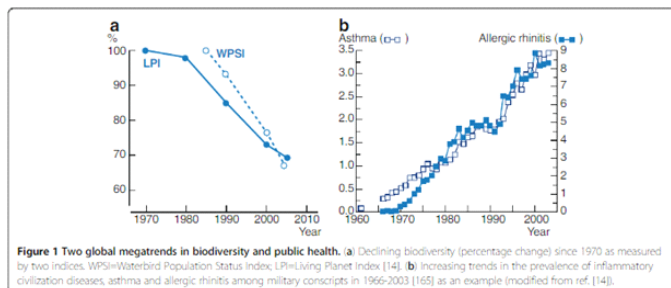
Morand (2017). Biodiversity and Health → A comprehensive textbook on current studies on biodiversity loss affecting health and/or causing health issues.

Sunderland (2011). International Forestry Review → A study/review on how biodiversity is important in maintaining stable food systems.

DISCUSSION

Disease Concerns

As humans cause dramatic changes in the biosphere, a trend that has been seen is an increased rate of diseases of all sorts worldwide; particularly in the developing world. Much of this has been attributed to a loss of biodiversity. Due to human sterilization of natural environments, gut and skin microbiota that worked with the human body have been demolished. Over 40% of children in the UK are affected by allergic maladies, with similar numbers recorded in the United States (Haahetela, 2013). These statistics are just one of the signs of a significant uptick in various inflammatory conditions, including asthma, allergic and inflammatory bowel diseases (IBD), Type 1 diabetes, and obesity due to the loss of biodiversity of gut and skin microbiomes. Combined with an unhealthy diet and sedentary lifestyle, which further damage the immune system, these conditions have diminished microbiome biodiversity and led to increased risks of harmful pathogens taking over.



Furthermore, habitat destruction and fragmentation has decreased structural diversity in ecosystems, which has led to changes in human contact rates with a variety of pathogens and disease vectors. One example of such is the “dilution effect”, a hypothesis that has been proposed for zoonotic diseases (Morand, 2017). It suggests that abundance diversity of host species play a protective role in preventing the spread of transferrable zoonotic diseases in humans. For example, high incidences of West Nile Virus and Lyme disease have been closely associated with changes in the diversity of animal hosts: house sparrows in the case of the West Nile Virus and squirrels in the case of Lyme disease, with both acting as disease vectors and diverting the danger of the disease arriving in humans (Pongisiri, 2009). Supporting this, a study on 61 species of parasites showed that biodiversity decreased parasite abundance (Morand, 2017).

Another cause of increased pathogen spread is the loss of predators from an ecosystem. As exemplified by the case study of Lake Malawi in Africa, where overfishing of mollusk-eating fish resulted in a greater number of *Bulinus* gastropods and the subsequent spread of schistosomiasis, a parasitic disease, damage to any part of an ecosystem can push the balance into havoc (Pongsiri, 2009). The ecosystem service of pathogen control is heavily damaged by human intervention in natural ecosystems: as biodiversity levels drop, the danger of infectious diseases continues to rise.

Furthermore, with diminishing biodiversity comes the danger of losing potential pharmaceuticals and drugs that can be derived from the natural world. Currently, only an estimated 10% of diverse species on Earth have been exploited to combat diseases while little over 12.5% of the approximately 250,000 species of higher plants have been used (Adebayo, 2019). However, through the natural world has come significant breakthroughs in medicine which have revolutionized healthcare. Aspirin, for example, was derived from the bark of the willow tree *Salix alba*. Roughly 60% of anticancer and anti-infective drugs were either derived from such natural products or were modeled on or modified after them (Adey, 2000). With biodiversity cut down by 30% over the past 40 years, the impact on medical discoveries and human health in the future could be drastic.

Food Security Concerns

Biodiversity and ecosystem services are the unseen factors behind stable food production. Maintaining food sources is one of the most valuable ecosystem services provided by a healthy, biodiverse environment. It is estimated that about 100,000 species of insects, birds, and mammals pollinate more than two-thirds of food plants and are responsible for 35% of the world's crop production. Furthermore, biodiversity in the microbiomes of soil and water sources are crucial in providing crops with the nutrients and relationships needed to flourish (Slavioka, 2016). However, with increased use of pesticides that damage soil microbiomes and a resounding decrease in bird and insect populations (down by over 20%), this leads to worrisome implications for crop production as a whole.

Furthermore, the loss of biodiversity in crop species also leads to more underlying concerns. Today, 12 plant crops and 14 animal species provide 98% of world's food needs; wheat, rice and maize alone account for more than 50% of global energy intake (Sunderland, 2011). This overreliance on few organisms in food production and widespread monocultures has led to the loss of many wild relatives of crop plants and livestock, which decreases genetic diversity, increases uniformity and makes these crops vulnerable to disease. One such outbreak across a single harvest of wheat could cause a death toll in the millions due to famine.

A loss of food security would be incredibly detrimental to human health. Further exasperating the issue, around one billion people rely on wild harvested products for nutrition and income. In India alone, over 6 million people rely on wild-harvested products as their primary source of nutrition and income (Sunderland, 2011). Loss of biodiversity in the ecosystems such communities rely on has disastrous effect on the availability of sustenance as the maintenance of watershed services, soil fertility, pollination, seed dispersal, and nutrient cycling all collapse (Sunderland, 2011). An estimated 24 percent of wild food species are decreasing in abundance, while the status of another 61 percent is not reported or known (Belanger, 2019). The largest wild-harvested food industry is the fishing industry. Fish provides about 3 billion people with almost 20 percent of their protein intake: however, about 30 percent of major marine stocks are overexploited, which causes a vicious cycle of biodiversity loss in marine ecosystems (Slavioka, 2016).

Taking into account all the ways biodiversity and the ecosystem services that stem from it improve food security, it is clear that with Earth's population on the increase, a loss of biodiversity has worrying implications for providing enough food to feed a growing human race. According to the World Economic Forum, by 2050, the world must feed 9 billion people. The demand for food will be 60% greater than it is today. Failing ecosystems with biodiversity loss is guaranteed to increase the scale of the issue and cause mass malnourishment and famine in the future unless something is done.

Counterarguments/Rebuttal

It continues to be debated whether or not biodiversity loss is actually a problem worthy enough of being given attention in today's age of climate change and global warming. It is true that climate change is a massive problem with worldwide consequences. It has caused mass natural disasters, including droughts, floods, and storms that have displaced many millions of people. It is a threat to humanity in a near and far more obvious sense. However, it should be taken into consideration that it isn't one issue that should be looked at a time. Biodiversity loss is interconnected with climate change, and vice versa. There have been multiple studies showing that with an increase in biodiversity, ecosystems such as grasslands, rainforests, and kelp forests rebound rapidly. These healthy environments play a huge role in carbon sequestration. Global reforestation initiatives often take into account the dangers of introducing invasive or non-native tree species into ecosystems: although they may grow quicker and therefore sequester carbon in a shorter time period, their long-term disadvantages outweigh the temporary benefits because of their potentially destructive impact on ecosystems.

Furthermore, healthy ecosystems provide copious amounts of protection from natural disasters such as storms and floods that are becoming more frequent because of climate change. A study conducted by researchers in Bangladesh assessing the impact of healthy mangroves on the intensity of storm surges found "a significant reduction in water flow velocity (29–92%) and a modest reduction in surge height (4–16.5 cm)". This supports the claim that healthy ecosystems can significantly decrease damage caused by these climate-change-induced natural disasters (Dasgupta, 2019). Other ecosystems such as marshlands, forests, and coral reefs work similarly. Healthy forests reduce risk of erosion and landslides. Healthy reefs reduce flooding damage. These ecosystems can only be maintained by ample biodiversity within them. Therefore, it is imperative biodiversity is discussed in tandem with climate change rather than as a separate, less vital issue.

Conclusion & Findings

The findings of this study conclude that a loss of biodiversity does indeed have great impacts on human health. The ecosystem services of pollination, disease/parasite control, and natural disaster prevention are vital to human wellbeing. Biodiversity around the world is crashing at an alarming rate due to human intervention in natural ecosystems, and this is proving to be an incredibly dangerous endeavor. A healthy, biodiverse ecosystem limits the spread of disease, boosts the human immune system, and establishes food security through pollination, raising genetic diversity in wild-caught foods, and supports healthy microbiomes that improve soil fertility. Therefore, it is imperative we pay closer attention to biodiversity conservation to improve human health.

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